# BRAKE LINING FOR A DISC BRAKE OF A VEHICLE

**[0001]** The present invention relates to a brake pad for a disc brake of a vehicle according to the preamble of Claim 1.

**[0002]** For vehicles, particularly rail vehicles, which reach high speeds, brake pads are used whose friction elements consist of a hard material.

**[0003]** In order to achieve a satisfactory contact pattern, that is, a uniform surface pressure of the friction elements on the friction surface of the brake disc, various constructive solutions are known.

**[0004]** Thus, cup springs are used, for example, which are supported on the back of the carrier plate and by means of which the connected friction elements are elastically disposed on the carrier plate. In another construction, the friction elements are elastically guided on spiral springs, while, according to another suggestion, the friction elements are connected with deformable intermediate metal sheets.

**[0005]** A so-called isobar brake pad is known from European Patent Document EP 0 784 761 B1 as well as German Patent Document DE 197 09 962 C1. In this case, the friction elements have spherical-segment-shaped areas on their side facing the carrier plate, which spherical-segment-shaped areas rest in ball sockets of the carrier plate adapted thereto. In the last-mentioned prior art, the friction elements, which otherwise have a hexagonal base, are held by means of tension springs which are supported on the back of the carrier plate.

**[0006]** In the case of the known brake pads, problems arise because of the relatively high-expenditure and cost-intensive production and a frictional behavior of the friction elements respectively, which frictional behavior is not quite sufficient because of the poor contact pattern despite the constructive measures carried out.

**[0007]** It is therefore an object of the present invention to further develop a brake pad of the above-mentioned type such that the frictional behavior of the friction elements is optimized and a more cost-effective production is permitted.

**[0008]** This object is achieved by means of a brake pad having the characteristics of Claim 1 or 2.

**[0009]** The integrated elasticity of shape of the carrier plate achieved by means of the invention according to Claim 1 improves the contact pattern as a whole and avoids, in

particular, so-called "hot spots", that is, an overstressing of areas as a result of non-uniform heating.

**[00010]** According to an advantageous further development of this invention, in which, corresponding to German Patent Document 197 09 962 C1, the friction elements are each fastened by means of tension springs on the carrier plate, a rigid connection subject to the risk of fracture between the two components is prevented, as it would exist, for example, in the case of a riveted or welded connection, so that this connection represents a considerable improvement of the operational reliability.

**[00011]** This also applies to a brake pad according to Claim 2, in which, in addition to the rear-side tension spring, by means of which the respective friction element is fastened to the carrier plate, another spring element is arranged between the friction element and the carrier plate, the spring element preferably resting in a receiving device of the carrier plate, which is built into the side facing the friction element.

**[00012]** The dimensions of the receiving device are such that the spring element with a preferably round base plan rests in it in an axially as well radially secured manner.

**[00013]** The tension spring is prestressed such that the friction element is constantly clamped in, thus also in the relaxed position of the spring element.

**[00014]** In comparison to the partial deformability of the carrier plate corresponding to Claim 1, the spring elements consisting of spring steel have a greater elasticity. When the spring elements are used, the carrier plate can be produced from a low-cost casting material or from low-strength steel sheet, whereby noticeable cost advantages are achieved.

**[00015]** Another contributing fact is that, in principle, only a few different components are present, specifically the carrier plate, the friction elements, the tensions springs and, in the case of a brake pad according to Claim 2, the spring elements. Furthermore, the simple construction permits an easy exchangeability of the friction elements because of wear, so that repair-caused interruptions of the operation can be kept extremely brief.

**[00016]** Such a modular construction of this brake pad also has the result that the friction element and spring components can be used unchanged, so that existing parts can be used without any problem. Thus, only the carrier plate has to be modified corresponding to the inventions.

[00017] In principle, the carrier plate according to Claim 1 can be produced by precision casting, which is particularly cost-effective. In addition to the construction as a cast steel or aluminum part, the construction as a deep-drawn steel sheet part is conceivable.

[00018] According to another idea of the invention, it is provided that radial slots are made in the area of the ball sockets of the carrier plate, which radial slots provide the ball sockets with a certain elasticity perpendicular to the friction surface. Instead of the slots, which extend continuously from the ball socket to the rear side of the carrier plate, grooves can also be provided by means of which the desired elasticity can also be achieved.

[00019] In addition to the above-mentioned radial arrangement of the slots, other arrangements are also conceivable, the elasticity in each case being achieved by a partial weakening of the material of the carrier plate.

[00020] This is also the case in an embodiment in which the ball socket is constructed in the sense of a cup spring, viewed over the radius, the thickness of the material being constant or changed.

[00021] Instead of the above-mentioned locally limited elasticity of the carrier plate, a locally unlimited elasticity can be provided which occurs outside the ball socket.

[00022] For this purpose, it is conceivable to dimension the carrier plate to be thinner and to provide elevations in the form of knobs or the like in the overlapping area of the friction elements, which knobs or the like are used as a support for the friction elements.

[00023] As a result of a uniform course of the thickness of the carrier plate or a course which is changed in a defined manner, a more or less elastic deformation can be established in the contact area of the friction elements.

[00024] Slots or grooves in the carrier plate outside the ball sockets which are arranged in a defined manner permit a certain elasticity in the supporting areas for the friction elements.

[00025] A further development of Claim 2 provides that each spring element is constructed as a form spring and has a concentrically arranged ball socket in which the spherical-segment-shaped area of the element rests. As a result of this, as it were, form closure, a radial fixing of the friction element is also achieved. This also exists when the corresponding area of the friction element is not spherical-segment-shaped but conical and the form spring is adapted thereto in its receiving area.

[00026] The form spring simultaneously has a stop by means of which its spring deflection is limited.

[00027] Instead of the form spring, a cup spring can be used as a spring element, as provided according to another idea of the invention. Since a commercially available standard part can be used here, this variant represents a particularly cost-effective solution.

[00028] Here, a positioning of the friction element is achieved by means of the center bore of the cup spring, in which either the spherical area of the friction element or a cylindrical or conical attachment rests which, with respect to its measurements is adapted to the internal bore.

[00029] As a result of a local plasticizing, the edge area of the center bore, because of occurring contact pressure forces, can be pressed so far into the spherical or conical area of the friction element that a form closure, which is exact with respect to the measurements, and a play free fit is achieved virtually without machining.

[00030] Expediently, the diameter of the receiving device of the carrier plate in which the cup spring rests is smaller than the assigned dimension of the friction element, so that the edge area of the carrier plate adjacent to the receiving device forms a stop, on which the friction element rests in the end position, so that the carrier plate bounds the spring travel of the cup spring.

[00031] Additional advantageous further developments of the invention are characterized in the subclaims.

[00032] Embodiments of the invention will be described in the following by means of the attached drawings.

[00033] Figure 1 is rear view as a partial cutout of an embodiment of a brake pad according to Claim 1;

[00034] Figure 2 is a sectional view of the brake pad according to Line II-II in Figure 1;

[00035] Figure 3 is a top view of a partial cutout of the carrier plate according to Figure 1 of the brake pad;

[00036] Figures 4 and 5 respectively are also rear views as a partial cutout of another embodiment of the brake pad according to Claim 1;

[00037] Figure 6 is a rear view as a partial cutout of an embodiment of the brake pad according to Claim 2;

[00038] Figure 7 is a sectional view of the brake pad according to Line VII-VII in Figure 6;

[00039] Figure 8 is a sectional view of the brake pad according to Line VIII-VIII in Figure 6;

[00040] Figure 9 is a partial sectional view of another embodiment of the brake pad according to Claim 2, corresponding to the sectional view in Figure 8.

[00041] Figure 1 illustrates a brake pad for a disc brake of a vehicle, particularly of a rail vehicle, which has a carrier plate 2 to which several friction elements 1 (Figure 2) made of a friction material are fastened on a carrier metal sheet, which friction elements can be pressed against the friction surface of a brake disc, which is not shown, when the brake is actuated.

[00042] As particularly clearly illustrated in Figure 2, the friction elements 1 have a spherical-segment-shaped area 8 on their side facing the carrier plate 2, which area 8 rests in a ball socket 3 adapted thereto and provided in the carrier plate 2.

[00043] As an axial lengthening, a holding pin 7 is molded to the spherical-segment-shaped area 8, in which holding pin 7 a ring-shaped tension spring 6 engages which is supported on the base of a rear-side recess 11 of the carrier plate 2.

[00044] As further illustrated in Figure 1 but also in Figure 2, radially arranged slots 4 are provided in the carrier plate 2 in the overlapping area of the friction elements 1, which slots 4 extend into the area of the ball socket 3, whereby the carrier plate 2 can be partially elastically deformed in the area defined thereby.

[00045] As a result of the radial arrangement of the slots 4, triangular webs are in each case formed between two slots, the spherical-segment-shaped area 8 of the friction element 1 resting on the apex area of the webs. The reaction force F, which becomes effective when the brake is actuated, can deform the above-mentioned apexes within the elasticity range.

[00046] As a cross-sectional view, Figure 1 illustrates that a guide strip 5 of a dovetail guide is provided on the rear side of the carrier plate 2, by means of which guide strip 5 the brake pad can be held in a form-locking manner on a stationary component of the vehicle.

[00047] Figure 3 only shows the carrier plate 2 with the provided recesses, thus the radial slots 4 as well as in the ball sockets 3, while the friction elements are not shown here.

[00048] In the embodiment illustrated in Figure 4, the carrier plate 2 is dimensioned with a smaller thickness.

[00049] In the overlapping area of the friction elements 1, projecting knobs 10 are arranged on the carrier plate 2, the friction elements resting against these knobs 10. The partially elastic deformability is formed by the knobs 10 interacting with the carrier plate whose thickness is dimensioned to be smaller. In this case, the thickness of the carrier plate 2

may be constant, but may also differ in a defined manner, whereby a precisely definable elastic deformation is obtained.

[00050] By means of the embodiment according to Figure 5, an also locally unlimited elasticity of the carrier plate 2 can be achieved. In this case, slots, which are arranged in a defined manner, are made in the carrier plate, which slots permit a corresponding deflection of the friction elements under stress.

[00051] Figure 6 shows a brake pad according to Claim 2 whose basic construction corresponds to that illustrated in Figures 1 and 2.

[00052] However, in contrast, the carrier plate 2 has no partially elastically deformable areas, but a receiving device 12, which is assigned to each friction element 1 and in which a spring element 13, 14 (Figures 8 and 9) rests, which, on the one side, is supported on the base of the receiving device 12 and, on the other side, is supported on the assigned friction element 1.

[00053] In the embodiment illustrated in Figures 7 and 8, the spring element 13 is constructed as a cup spring which rests on the friction element 1 by means of the edge of its internal bore.

[00054] In this case, the depth of the receiving device 12 is smaller than the height of the relaxed cup spring, so that the friction element 1 extends at a short distance from the carrier plate 2.

[00055] Simultaneously, the base plan dimension of the receiving device 12 is smaller than that of the friction element 1, so that the edge area of the carrier plate 2 adjoining the receiving device 12 forms a stop for the friction element 1 during the pressing-on in the direction of the carrier plate 2.

[00056] The inside diameter of the cup spring 13 corresponds approximately to the diameter of the spherical-segment-shaped area 8 at a location where the latter otherwise adjoins the friction element 1. As a result, a radial fixing of the friction element 1 is achieved.

[00057] The spring travel of the tension spring 6 is greater than the limited travel of the friction element 1, so that the latter is under spring tension even when it rests completely against the carrier plate 2.

[00058] In Figure 9, the spring element 14 is illustrated in the form of a form spring which has a concentrically arranged spherical-cap-type indentation 15 in which the spherical-segment-shaped area 8 of the friction element 1 rests in a centered manner.

[00059] Since, by means of its edge area bounding the indentation 15, the form spring 14 rests against the rear side of the friction element 1, as a result of the indentation 15 in addition to a centering, a radial fixing of the friction element 1 is also ensured.

[00060] The outside diameter of the form spring 14, like that of the cup spring 12, correspond to the outside diameter of the receiving device 12, so that the cup spring 13 as well as the form spring 14 rest inside in a secured manner.

[00061] Furthermore, a collar 16 is provided which surrounds the form spring and extends axially in the direction of the friction element 1, which collar 16 extends at a certain distance from the rear side of the friction element and forms a stop for the spring travel of the form spring 15 during the operation-caused pressing-in.

[00062] List of Reference Numbers

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| 1 | Friction element |
| 2 | carrier plate |
| 3 | ball socket |
| 4 | slots |
| 5 | guide strip |
| 6 | tension spring |
| 7 | holding pin |
| 8 | spherical-segment-shaped area |
| 9 | slots |
| 10 | knobs |
| 11 | recess |
| 12 | receiving device |
| 13 | spring element |
| 14 | spring element |
| 15 | indentation |
| 16 | collar |